PROKHOROV, N. K.

Tangerine

Raising frost-resistance of the tangerine tree. Agrobiologiia No. 3, 1952
Sochinskaya opytnaya stansiya subtropicheskikh i yuzhnykh plodovykh kul'tur

SO: Monthly List of Russian Accessions, Library of Congress, September 1952 , Uncl.

VASIL'YEVA, Natal'ya Petrovna; GASHKOVETS, Irzhi Stefan; PROKHOROV, N.L., red.; BUL'DYAYEV, N.A., tekhn. red.

[Logic elements in industrial automatic control systems]Logicheskie elementy v promyshlennoi avtomatike . Moskva, Gosenergoizdat, 1962. 159 p. (Biblioteka po avtomatike, no.68) (MIRA 16:1)

(Switching theory) (Automatic control)
(Electronic computers--Circuits)

55

PROKHOROV, N. L.

PHASE I BOOK EXPLOITATION SOV/6012

Akademiya nauk SSSR. Institut avtomatiki i telemekhaniki.

Avtomaticheskoye regulirovaniye i upravleniye (Automatic Regulation and Control) Moscow, Izd-vo AN SSSR, 1962. 526 p. Errata slip inserted. 9000 copies printed.

Resp. Ed.: Ya. Z. Tsypkin, Professor, Doctor of Technical Sciences; Ed. of Publishing House: Ye. N. Grigor'yev; Tech, Ed.: I. N. Dorokhina.

PURPOSE: This book is intended for scientific research workers and engineers concerned with automation.

COVERAGE: The book is a collection of articles consisting of papers delivered at the 7th Conference of Junior Scientists of the Institute of Automation and Telemechanics, Academy of Sciences USSR, held in March 1960. A wide range of scientific and technical questions relating to automatic regulation and control is covered.

Card 1/12

53

The articles are organized in seven sections, including automatic control systems, automatic process control, computing and decision-making devices, automation components and devices, statistical methods in automation, theory of relay circuits and finite automatic systems, and automated electric drives. No personalities are mentioned. References are given at the end of each article.

TABLE OF CONTENTS:

PART I. AUTOMATIC CONTROL SYSTEMS

PART IV. AUTOMATION COMPONENTS AND DEVICES

PROKHOROV, N.M.; PECHKOVSKIY, V.V.

Investigating ceramic molds for precision casting. Lit. proizv. 5:26-28 My '64. (MIRA 18:3) [illegible], V.A.; [illegible] V. V.I.

Apparatus for the complex study of the properties of precision cast ceramic molds. [illegible] 30 no.5:623-625 '64. (MIRA 17:5)

1. Permskiy politekhnicheskiy institut.

APPROVED FOR RELEASE: 06/15/2000 CIA-RDP86-00513R001343120016-0"

1ST AND 2ND ORDERS PROCESSES AND PROPERTIES INDEX

7

B

*584. **Differential Means of Determining Stresses.** (In Russian.) N. N. Prokhorov. *Avtogennoe Delo* (Welding), Aug. 1947, p. 20-22.
Method proposed permits analyzing the stress state of the metal during the entire welding cycle.

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

PROKHOROV, N. N.

PA 4T31

USSR/Welding - Strength
Joints, welded

Mar 1947

"Equal Durability of Welded Butt-joints," N N Prokhorov, N V Shiganov, and A V Mordvintseva, 4pp

"Avtogennoye Delo" No 3

Discussion with tables, microphotos and diagrams. The conclusion, among others, is reached that the low durability of this type of welding, as shown by statistics, is due to the imperfect form of the joints, and the presence in them of undercuts and poor penetrations

4T31

PROKHOROV, N. N.

USSR/Structures - Welding Mar 1947

"Stresses in Welded Structures," G. A. Nikolaiev and N. N. Prokhorov, 12 pp

"Izvestiya Akademii Nauk USSR, Otd Tekh," No 3

Highly technical treatment of welding strains and stresses.

Graphs

PA 1T32

PROKHOROV, N. N.

PA 4T39

USSR/Welding
Steel

Apr 1947

"The Weldability of Mark 3M Steel," N N Prokhorov and I I Makarsov, 2 pp

"Avtogennoye Delo" No 4

Experimental data, graphs and diagrams. It is concluded that the weldability of 3 M steel is satisfactory.

4T39

PROCESSES AND PROPERTIES INDEX

13

16

*208. **Mechanical Tensometer for Determination of Deformation in Bodies During Temperature Changes.** (In Russian.) N. N. Prokhorov, N. V. Shiganov, and A. V. Mordvintseva. *Zavodskaia Laboratoriya* (Factory Laboratory), v. 13, Sept. 1947, p. 1148-1149.

Above apparatus is described and diagrammed and typical results obtained with it are presented.

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

7

B

Local Elastic and Plastic Deformation During the Welding of Rods onto Sheets. (In Russian.) N. N. Prokhorov, N. V. Shiganov, and A. V. Mordvinsteva. *Avtogennoe Delo* (Welding), Feb. 1948, p. 12-15.

Results of investigations, which are charted, show that deformation often takes place on cooling, resulting in cracks. The rate and amount of this deformation increases with increasing plate width. Proposes cooling the zone adjacent to the weld by means of water.

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

B

1

The Problem of the Mechanical Properties of Metals During the Welding Process. (In Russian.) N. N. Prokhorov and P. M. Lyubalin. *Avtogennoe Delo* (Welding), Nov. 1948, p. 16-18.

The ductilities of steels of both pearlite and austenite type were investigated at temperatures approaching those of welding (1000-1100°C.) and also between 25 and 200°C. The dependence of ductility on different factors is indicated.

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

MASTRYUKOVA, A.S., kand. tekhn. nauk; PROKHOROV, N.N., doktor tekhn. nauk

Calculating crystallization isotherms during the butt welding of plates. Svar. proizv. no.8:5-7 Ag '63. (MIRA 17:1)

1. Moskovskoye vyssheye tekhnicheskoye uchilishche imeni Baumana.

PROKHOROV, N. N. and N. V. SHIGANOV

Proizvodstvo svarnykh mnogo-sloinykh sosudov vysokogo davleniia. (Vestn. Mash., 1948, no. 6, p. 33-37)

Production of welded multilayer high-pressure vessels.

DLC: TN4,V4

SO: Manufacturing and Mechanical Engineering in the Soviet Union, Library of Congress, 1953.

PROKHOROV, N. N. and S. A. KURKIN

Ustanovka dlia nizkotemperaturnogo sniatiia ostatochnykh napriazhenii v svarnom shve. (Vestn. Mash., 1948, no. 9, p. 31-33)

Installation for low-temperature removing of residual stresses in a welded seam.

DLC: TN4, V4

SO: Manufacturing and Mechanical Engineering in the Soviet Union, Library of Congress, 1953.

PROKHOROV N. N.

THE CONTROL OF THE DISTORTION OF THIN SHEETS DURING ARC BUTT WELDING. N. N. Prokhorov. (Avtogennoe Delo, 1948, No. 10, pp. 17-20). (In Russian). An account is given of experiments in which the deformations due to welding of low-carbon steel plates 700 x 400 mm. with thicknesses of 2, 3, and 4 mm. were measured. Measurements were made both of local deformation during the welding in areas of the metal at temperatures up to 900°C., and of residual deformations. It is concluded that deformation in a sheet bead-welded along one edge is due to temperature stresses and this can be reduced by a more uniform temperature distribution; the application of uniform pressure to the region paralled to the seam, and at a distance of two to five times that sheet thickness, is an effective way of reducing deformation.

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CA

7

Strength of metals in welding. N. N. Prokhorov and P. M. Lyubalin. *Avtogennoe Delo* **1948**, No. 11, 16-18. — On cooling from a temp. range corresponding to welding conditions, steels of the pearlitic class show a fall of plasticity between 1000-1400° and 25-200°. This confirms the hypothesis of "hot" and "cold" cracks occurring in welding. An austenitic steel showed max. plasticity on complete cooling, in keeping with the absence of cold cracks. In pearlitic steels, plasticity, over the whole range of the cooling, is lower the higher the temp. of previous heating. High-temp. brittleness, and hot-crack formation, are both due to intercrystn. disruption. There is a complete parallelism between cracking in welding and plasticity on cooling. That this relation was heretofore overlooked is due to the fact that changes of plasticity were heretofore investigated only on cooling from too low an initial temp. N. Thon

PROKHOROV, N. N.

Puti povysheniia prochnosti truboprovodov. (Vestn. Mash., 1949, no. 6, p. 33-38)

Methods of increasing the endurance of pipe lines.

DLC: TN4.V4

SO: Manufacturing and Mechanical Engineering in the Soviet Union, Library of Congress, 1953

PROKHOROV, N. N.

PA 167T83

USSR/Metals - Welding Oct 50

"Investigation of the Mechanical Properties of Steels Under the Temperature Conditions of a Simulated Welding Process," N. N. Prokhorov, Cand Tech Sci, S. A. Kurkin, Engr

"Avtogen Delo" No 10, pp 6-10

One of a series of works on improvement of welded structures, conducted in welding lab of Moscow Higher Tech School under supervision of Prof G. A. Nikolayev. Problem: to establish parameters which cause tendency of metals to hot cracks in welding process. Proves formation of hot cracks takes

167T83

USSR/Metals - Welding (Contd) Oct 50

place at temperatures in region of solidus line and concludes that metallurgical modification of properties of steel may produce types of steel resistant to formation of hot cracks in welding.

167T83

PROCESSES AND PROPERTIES INDEX

2557* Investigation of Mechanical Properties of Steel Resulting From Temperatures Similar to Those Produced During Welding. (In Russian.) N. N. Prokhorov and S. A. Kurkin. *Avtogennoe Delo* (Welding), v. 21, Oct. 1950, p. 6-10.

Above investigation showed that the probability of formation of hot tears during welding occurs at temperatures near the solidus line. Steels with a large temperature range of restoration of plasticity were found to be more liable to form hot tears, and steels which reduce their intercrystalline strength slowly during cooling of the weld are more subject to the influence of variations in welding conditions. Experimental data are charted for different types of steel. Method of investigation is described.

ASM-SLA METALLURGICAL LITERATURE CLASSIFICATION

PROKHOROV, N. N.

"Technological Strength of Welded-on Metal in the Process of Welding." Sub 23 Apr 51, Moscow Order of the Labor Red Banner Higher Technical School imeni Bauman.

Dissertations presented for science and engineering degrees in Moscow during 1951.

SO: Sum. No. 480, 9 May 55.

PROKHOROV, N.N.

PHASE I Treasure Island Bibliographic Report

BOOK

Author: PROKHOROV, N.N., Doctor of Technical Sciences

Full Title: HEAT CRACKS IN WELDING

Transliterated Title: Goryachie treshchiny pri svarke

Publishing Data

Originating Agency: None.

Publishing House: State Publishing House of Scientific-Technical Literature on Machine Building. (Mashgiz). Moscow.

Date: 1952. No. pp.: 220 No. copies: 6,000.

Editorial Staff

Editor: Shterling, S.Z., Asst. Prof. Technical Editor: Golovin, S.Ya., Engineer.

Editor-in-Chief: None.

Appraiser: Okerblom, N.O., Prof., Doctor of Technical Sciences

Others: Gratitude is expressed to:

Nikolaev, G.A., Prof.
Mordvintseva, A.V., Eng.
Kurkin, S.A., Eng.
Bagryanskiy, K.V., Eng.
Shiganov, N.V., Eng.
Grigorovich, G.A., Eng.
Kazennov, Yu.I., Eng.
Alekseeva, L.V., Eng.

Text Data

Coverage: The work, which is based on latest research findings, is primarily concerned with causes of heat cracks in metal during the process of welding. Equipment and methods for determining the durability

PROKHOROV, N.N.

C0000057

Card 2/2

Call No.: TS227.P75

Full Title: HEAT CRACKS IN WELDING

Text Data

Coverage: (continued)
of welded seams are described. 169 Diagrams and charts.
29 Tables.

Purpose: The work is written for research personnel of scientific institutes; and, for engineers working with welding problems.

Facilities: Moscow Higher Technical School (im. Bauman) welding laboratory.

No. of Russian References: Of 105 references, 90 are Russian.

Available: Library of Congress.

PROKHOROV [redacted]

Causes of the appearance of hot cracks during welding. Avtom. svar. 7 no.6(39):52-58 N-D '54. (MLRA 8:2)

1. Moskovskoye vyssheye tekhnicheskoye uchilishche im.Baumana. (Welding)

PROKHOROV, N.N.

✓The intercrystalline metal strength during the welding of metals. N. N. Prokhorov. *Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk* 1955, No. 11, 34–49.—The relation between the deformation rate and the plasticity was studied under conditions of predominantly diffusional deformation. The results justify amplifying with addnl. data the previously published scheme (*Avtogennoe Delo*, No. 8, (1947)) which characterizes the intercryst. metal strength during welding. The tests were run on sheet Al specimens of standard shape in a specially constructed app., in which the specimen was made to rest on a heavy Cu plate of high sp. heat to maintain a uniform temp. throughout the specimen and to prevent any deformation caused by its own wt. A no. of photographs show fractures at 600–60°, obtained at variable annealing time; diagrams of changes in tensile strength and elongation per unit length with the temp. at 610–50° are reproduced. W. M. Sternberg

AID P - 5062

Subject : USSR/Engineering-Welding

Card 1/1 Pub. 107-a - 2/11

Author : Prokhorov, N. N.

Title : Strength of metals in welding crystallization

Periodical : Svar. proizv., 6, 5-11, Je 1956

Abstract : The existing theories on the subject are outlined, and the author's own hypothesis on formation of cracks in the intervals of rising temperature and ensuing brittleness of welded metal, is graphically presented and explained. The existing methods of test for the strength of metals in the process of crystallization during the welding are also outlined and briefly discussed. Nine drawings; 15 Russian references (1941-55) and 4 Non-Russian references (1938-54).

Institution : Moscow Higher Technical School (MVTU) im. Bauman

Submitted : No date

AID P - 5400

Subject : USSR/Engineering

Card 1/1 Pub. 107a - 2/12

Author : Prokhorov, N. N., Dr. of Tech. Sci., Prof.

Title : Production of higher-quality electrode wire by method of forced zonal liquation.

Periodical : Svar. proizv., 10, 6-9, O 1956

Abstract : The author describes his method of forced zonal liquation in the steel ingots from which a high-quality electrode with a minimum content of carbon, sulfur and phosphorus is drawn. Three photos (18 pictures), 8 charts and graphs; 1 Russian reference (1952).

Institution : Moscow Higher Technical School im. Bauman (MVTU im.Bauman).

Submitted : No date

PROKHOROV, N.N.

135-6-1/13

SUBJECT: USSR/Welding.

AUTHORS: ~~Prokherov, N.N.,~~ Dector of Technical Sciences, and Alayev, V.M., Engineer.

TITLE: On the Celd Brittleness of Weld Joints in Low-Carbon Steel. (O khladnelomkosti svarnykh seyedineniy iz nizkouglerodistoy stali)

PERIODICAL: "Svaróchnoye Preizvodstve", 1957, # 6, pp 1-4 (USSR)

ABSTRACT: The authors give a brief review of the data available on the subject, references to sources in literature, and remark that the question of the effect of residual welding stresses on the critical point of celd brittleness is yet open. Furthermore, the article describes in detail the authors' own experiments on large specimens under conditions, immediately after welding and after heat treatment. Steel "MCT.3" was used as experimental material. Welding was performed in accordance with regulations of the Welding Institute of USSR Academy of Sciences for preparation of specimens for cold brittleness tests. The shape of specimens is shown by drawings. The residual stresses were measured by an electric tensometer and by

Card 1/3

135-6-1/13

TITLE: On the Cold Brittleness of Weld Joints in Low-Carbon Steel. (O khladnolomkosti svarnykh soyedineniy iz nizkouglerodistoy stali)

X-ray analysis. Stress relieving (in one group of specimens) was done by the usual tempering during 2 hours at about 650°C with subsequent cooling in the oven. Impact bending tests at various temperatures were conducted on a special ram impact device (shown by drawing).

Conclusions were reached that:

1. The residual stresses in low-carbon steel do not materially affect the critical brittleness temperature of a steel "MCT. 3" specimen under given load.
2. The heat-treated specimens had a considerably higher impact resistance than the merely welded samples but it was difficult to evaluate this difference fully without further broad investigations.

In accordance with the data obtained by subject and by some additional experiments, the Welding Faculty of the "МВТУ" recommended in 1955 to reduce to a certain degree the technological cycle of producing a series of welded heavy-duty construc-

Card 2/3

135-6-1/13

TITLE: On the Cold Brittleness of Weld Joints in Low-Carbon Steel. (O khladnolomkosti svarnykh soyedineniy iz nizkouglerodistoy stali)

tions of thick-section low-carbon steel by reducing the temperature and the duration of stress-relief tempering after welding.

The article contains 3 tables, 3 diagrams, 4 drawings, and 16 references (11 of which are Russian).

ASSOCIATION: "MBTY" imeni Baumana (MVTU imeni Bauman)

PRESENTED BY:

SUBMITTED:

AVAILABLE: At the Library of Congress.

Card 3/3

SOV-135-58-2-1/18

AUTHORS: Prokhorov, N.N., Doctor of Technical Sciences, Professor; Bochay, M.P., Engineer

TITLE: Mechanical Properties of Aluminum Alloys in the Temperature Interval of Crystallization in Welding Processes (Mekhanicheskiye svoystva alyuminiyevykh splavov v intervale temperatur kristallizatsii pri svarke)

PERIODICAL: Svarochnoye proizvodstvo, 1958, Nr 2, pp 1 - 6 (USSR)

ABSTRACT: The purpose of the described experimental investigation was to find mechanical properties of Al-Cu and Al-Si alloys in the temperature interval of initial crystallization, i.e. when hot crack formation occurs. Information includes detailed description of the testing machine (Fig.1). Existing literature /Ref.1-5/ on this subject is discussed and results of the experiments are presented with the following conclusions: 1) alloys with a low (Cu 0.5% Si-0.4%) or a high (Cu-3 to 7%; Si 1.5 to 5%) content are relatively fast in restoring strength in the temperature interval; 2) alloys

Card 1/2

SOV-135-58-2-1/18

Mechanical Properties of Aluminum Alloys in the Temperature Interval of Crystallization in Welding Processes

with a content of Cu 1 to 2% and Si 0.6 to 1% are relatively slow in restoring strength in proportion to the dropping temperatures; 3) eutectic alloys possess the highest strength reserve. S.V. Lashko-Avakyan prepared the investigated specimens. There are 7 graphs, 1 diagram, 8 photos and 5 Soviet references.

ASSOCIATION: MVTU imeni Baumana (MVTU imeni Bauman)

Card 2/2

1. Aluminum alloys--Mechanical properties 2. Aluminum alloys--Temperature factors

SOV-135-58-9-6/20

AUTHORS: Prokhorov, N.N., Doctor of Technical Sciences, Professor and Makarov, E.L., Engineer

TITLE: Methods of Evaluating Steel Resistance to Cold Crack Formation in Welding (Metodika otsenki soprotivlyayemosti staley obrazovaniyu kholodnykh treshchin pri svarke)

PERIODICAL: Svarochnoye proizvodstvo, 1958, Nr 9, pp. 15-18 (USSR)

ABSTRACT: Information is presented on methods of investigating the sensitivity of welded joints in different grades of steel (chemical composition given in a table) to cold crack formation. The proposed methods were developed by the authors together with K.I. Zaytsev and Aspirant Syuy-Tszy-Tsay (1950 - 1955). The article contains detailed description of tests, investigated specimens, devices and technology used, including investigation of zones adjacent to seams, artificial cooling, preheating and subsequent heating of the specimens. The performed tests proved that

Card 1/2

SOV-135-58-9-6/20

Methods of Evaluating Steel Resistance to Cold Crack Formation in Welding

the described method can be successfully applied in scientific research organizations in order to gather data for practical use. There are 6 diagrams, 5 graphs, 1 table, 2 sets of photos and 2 Soviet references.

ASSOCIATION: MVTU imeni Baumana (MVTU imeni Bauman)

1. Welded joints--Fracture 2. Welded joints--Test results

Card 2/2

PROKHOROV, N.N.

25(1); 18(5) PHASE I BOOK EXPLOITATION SOV/2859

Akademiya nauk SSSR. Institut metallurgii

Goryachiye treshchiny v svarnykh soyedineniyakh slitkakh i otlivkakh (Hot Cracks in Welds, Ingots, and Castings) Moscow, Izd-vo AN SSSR, 1959. 163 p. 2,700 copies printed.

Ed.: N. N. Rykalin, Corresponding Member, USSR Academy of Sciences; Ed. of Publishing House: V. S. Rzheznikov; Tech. Ed.: Yu. V. Rylina.

PURPOSE: This book is intended for metallurgists and welding engineers.

COVERAGE: This is a collection of scientific papers dealing with the formation of hot cracks in ingots, castings, and welded products. Some papers are concerned mainly with the nature or mechanism of the phenomenon; others examine the effect of factors such as steelmaking procedure. Sufficient evidence is presented to identify some of the causes of hot cracks. Various means of investigating and preventing the phenomenon are described. A number of references, both Soviet and non-Soviet, accompany the papers. ~~For further coverage~~

Prokhorov, N. N. Intergranular Strength of Metals 108

The author points out that hot cracks are one of the main causes of rejection of welded and cast products. To solve the problem he suggests intensive study of the hot strength of metals, using several different approaches: 1) investigation of deformations caused by welding and casting processes, accompanied by development of computational methods of determining deformations and their concentration at high temperatures; 2) study of the mechanical properties of metals during crystallization and cooling; 3) development of a single working hypothesis of intergranular strength of metals which would guide investigators and manufacturers in solving theoretical and practical problems connected with hot-crack formation (in this connection the author suggests the utility of his own hypothesis, based on a comparison of the numerical values of the deformation and plasticity of metals within a definite temperature range of brittleness); development of unified methods of testing metals for susceptibility to hot-crack formation in welding and casting; 5) development of quantitative methods of determining the effect of the shape of the product, as required by manufacturing and constructional considerations, on intergranular strength of welded and cast products; 6) systematic adoption of new scientific methods by manufacturers.

Lashko-Avakyan, S. V., and N. F. Lashko. Intergranular Crystallization Cracks in the Casting and Welding of Aluminum Alloys 131

According to the author, certain alloys ordinarily subject to the formation of cystallization cracks after welding can be rendered resistant to such cracks by the use of an added metal (alloy) which satisfies the following conditions: (a) the weld metal must not be subject to crack formation after welding; (b) the liquidus temperature of the weld metal must not be higher than that of the parent metal; (c) the weld metal must not contain components that in penetrating the base metal along the boundaries of fused grains in the heat-affected zone would form alloys with significantly lower eutectic temperatures than that of the base metal.

SOV/129-59-3-3/16

AUTHORS: Prokhorov, N.N., Doctor of Technical Sciences, Professor and Makarov, E.L., Gospodarevskiy, V.I., Engineers

TITLE: Investigation of the Kinetics of Decomposition of Austenite in Steels During Welding (Issledovaniye kinetiki raspada austenita v stalyakh pri svarke)

PERIODICAL: Metallovedeniye i Termicheskaya Obrabotka Metallov, 1959, Nr 3, pp 13 - 16 (USSR)

ABSTRACT: "Cold cracks" during welding form in the process of decomposition of austenite. The kinetics of decomposition of austenite are determined to a considerable extent by the resistance of the steel to the formation of cold cracks. Cottrell (Refs 1, 2) as well as the authors of this paper investigated the relation between the temperature of completion of the decomposition of austenite (measured dilatometrically) and the resistance of the steels to the formation of cold cracks during welding. Critical temperatures were established at which the process of decomposition of the austenite is completed and below which the tendency of the steels to crack formation increases sharply. In this paper, the kinetics of the decomposition of austenite was investigated

Card1/4

Investigation of the Kinetics of Decomposition of Austenite in Steels During Welding

magnetometrically of welded specimens on a specially designed instrument, the principle of operation of which is based on recording of the changes in the magnetic properties of the steel during $Fe_{\gamma} \rightarrow Fe_{\alpha}$ transformation in the process of cooling after welding. In the thermally influenced zone of the basic metal the material changes into the austenitic state and becomes non-magnetic. During decomposition of the austenite the welded joints assume a magnetic conductivity. Recording of the changes in the magnetic conductivity of the welded joint together with changes in the temperature in the zone around the joint at the fusion line permits investigating the kinetics of decomposition of the austenite during welding. A sketch of the instrument is shown in Figure 1, p 14. It consists of a П-shaped core which carries two coils; one of these generates a DC flux in the core; the other measures the magnetic flux of the core. During operation the magnetic circuit is closed with the welded specimen, which consists of two plates, 10 x 50 x 100 mm; these

SOV/129-59-3-3/16

Investigation of the Kinetics of Decomposition of Austenite in Steels During Welding

are open-circuited prior to welding. During cooling of the specimen after welding the magnetic circuit is gradually closed by the welded joint as the austenite decomposes. Re-establishment of the magnetic conductivity in the welded joint of the specimen leads to an increase in the magnetic flux of the core. The resulting changes of the magnetic flux induces an e.m.f. in the metering coil, which is either measured by a galvanometer or recorded oscillographically simultaneously with the temperature of the specimen. The chemical compositions of the steels from which the test specimens were made are entered in a table, p 15. In one series of experiments, the speed of cooling of the specimens from 500 °C was 5 °C/sec; in another, it was 20 to 25 °C/sec. In Figure 4, the temperatures of austenite decomposition during welding are garphed for various steels. In Figure 5, the dependence is graphed of the resistance of steels against the formation of cold cracks during welding on the temperature of completion of the autenite decomposition (Curve A) and on the maximum intensity of the austenite decomposition (Curve B)

Card3/4

SOV/129-59-3-3/16

Investigation of the Kinetics of Decomposition of Austenite in Steels During Welding

The described method of study of the kinetics of decomposition of the austenite during welding enables approximate evaluation of the resistance of steels to forming cold cracks as a result of various regimes of welding.
There are 5 figures, 1 table and 3 references, 2 of which are English and 1 Soviet.

ASSOCIATION: MVTU imeni Bauman

Card 4/4

SOV/135-59-8-4/24

18(5,7)

AUTHORS: Prokhorov, N.N., Doctor of Technical Sciences, Makarov, E.L., Engineer, and Yakushin, B.F., Engineer

TITLE: Strength of Steel in the Process of Austenite Transformation During Welding

PERIODICAL: Svarochnoye proizvodstvo, 1959, Nr 8, pp 12-15 (USSR)

ABSTRACT: Metallographic examinations of the cold cracks in the zone thermic effect in joints of low-alloy steels show, that the cracks are brittle and are mostly found at the periphery of the initial authenite cores. Figure 1 shows a microphoto of a typical crack in the zone near a welding seam of low-alloy steel. It can be seen that the crack goes along the edge of the cores and only in some cases cuts through the core. Figure 2 shows a cold crack of short length, which was found in the zone of thermic influence on a sample of low-alloy steel, which had been tested in regard to its tendency to form cracks. This microphoto clearly shows the inter-crystalline character of the cold cracks. An analysis of the damages in the formation

Card 1/5

SOV/135-59-8-4/24

Strength of Steel in the Process of Austenite Transformation During Welding

of cold cracks thus permits the assumption, that cold cracks are formed on the edges of the cores. In the literature this assumption is confirmed. Consequently a kinetic analysis of the mechanical qualities in the disintegration process of the austenite, taking in regard certain conditions causing the inter-crystalline destruction of the steels, must be the basis for an estimation of the tendency of steels to form cold cracks. If the timing conditions are neglected in the tests, the character of the destruction is changed; i.e. the inter-crystalline destruction is replaced by the inner-crystalline one. The results obtained in such tests cannot be used to estimate the tendency of the steels to form cold cracks during the welding. There is no agreement between the mechanical characteristics of the steel under the conditions in the zone of thermic influence of the welding seam and the tendency of these steels to form cold cracks during the welding. In tests with constant loads, however, a certain agreement between these characteristics was

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obtained. In these tests the steel decayed because of brittleness, which was partly inter-crystalline and partly inner-crystalline, under loads which were considerably below the breaking strength. The destruction of the steel in this case was similar to that, which was observed as a cause of the formation of cold cracks in the zone of the thermal influence of the welding. The study which is here presented gives the results of mechanical tests of steels, which were heat-treated in the welding cycle under different speeds of deformation. For the tests a machine was constructed which differs from the common types by that its motion speed for the moveable arms was changed in the limits of 22 - 0.00015 mm/s. The machine consists of the following main parts: the system to heat the sample in the given time by exposing it to an electric current; the mechanical gear; and the mechanism to register the strength and the elongation of the part during the destruction. The scheme of the machine is given in figure 3. In the following

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Strength of Steel in the Process of Austenite Transformation During Welding

part the machine is described in detail. The diagram "force-deformation" is written on a sheet of paper which is fixed on a drum. The methods of the examinations were developed in the welding laboratory of the MVTU and are perfected in this study. The tests were carried out with flats of 3x15x135 mm with a circular turned hole in the center. The tests were carried out for three thermic cycles, which are characterized by a heating up to 1300°C in 8-10 sec. and a medium cooling speed of 5, 20, and 200°C sec at 500°C. The deformation strength was determined by the bending power of the dynamometric spring. After the destruction the durability limits and the cross contraction were determined. The thermic welding cycle in testing the formation of cracks was selected similarly to that in the tests of the mechanical characteristics. As the data show that the durability changes under retarded destruction just as the resistability of steels against the formation of cold cracks in the welding. Analyzing the inter-crystalline

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Strength of Steel in the Process of Austenite Transformation During Welding

destructions of the metal it must by all means be considered that it is caused by certain conditions of temperature and time of the load and the structure of the metal. The resistability to deformations on the edges of the cores changes with the alterations in the toughness of the inter-crystalline layers and in the deformation speed. In the deformation process of the austenite the inter-crystalline layers are also tough, but the tenacity rises considerably. The mechanical characteristics of steel, which is treated in a thermic welding cycle, can be used for a relative estimation of the strength of the basic metal to resist the formation of cracks in welding. There are 4 photographs, 4 graphs, 2 diagrams and 12 references, 7 of which are Soviet and 5 English.

ASSOCIATION: MVTU im. Baumana (Moscow Higher Technical School im. Bauman)

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SOV/32-25-2-21/78

18(7)

AUTHORS: Prokhorov, N. N., Makarov, E. L., Gospodarevskiy, V. I.

TITLE: Methods of Physical Examination (Fizicheskiye metody issledovaniya). The Investigation of the Decomposition Kinetics of Austenite in Steels Under the Conditions of a Thermal Welding Cycle (Issledovaniye kinetiki raspada austenita v stalyakh v usloviyakh termicheskogo tsikla svarki)

PERIODICAL: Zavodskaya Laboratoriya, 1959, Vol 25, Nr 2, pp 164 - 166 (USSR)

ABSTRACT: The decomposition kinetics of austenite determine the character of the mechanical property changes in steel (e.g. the increase of internal structural tensions and the factors influencing the cold-shortness). The investigations described in the present paper were carried out by means of a newly designed photomechanical special dilatometer. The apparatus works on the principle of determining the test distortions by measurements of photoresistors (of the FS-K2 type). The thermal processing of the dilatometric samples is done by passing through electric current. The dilatometer consists of a mechanical distortion meter, an optical system and the photoresistor with an electron amplifier (Fig 1).

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Methods of Physical Examination. The Investigation of the SOV/32-25-2-21/78
Decomposition Kinetics of Austenite in Steels Under the Conditions of a
Thermal Welding Cycle

The sample (3 x 5 x 100 mm) can be quickly heated to a high temperature by passing through a powerful current. It is protected from oxidation by being placed in an inert-gas circuit. The temperature is measured by thermoelements, and the cooling velocities are recorded on an oscillograph 1) at 500°, approximately 20° per second, and 2) at 500° and approximately 5° per second. 15 types of steel were tested (Table), the samples were heated up to 1200°, and the cooling was done by one of the two cycles mentioned above. A representation of the thermal cycles and dilatometric curves of the 40Kh steel is contained in the paper (Fig 2). In the tests with an electrode (with a UONII 13/45 cover) on weakly alloyed wire, the steel welding was carried out in accordance with the thermic cycles of the dilatometric investigations. The investigation results (Fig 4) prove that under the welding conditions described, with austenite decomposition and temperatures below 300°, steels show a marked reduction of the resistance to cracking due to low temperatures. There are 4 figures and 1 table.

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Methods of Physical Examination. The Investigation of the SOV/32-25-2-21/78
Decomposition Kinetics of Austenite in Steels Under the Conditions of a
Thermal Welding Cycle

ASSOCIATION: Moskovskoye vyssheye tekhnicheskoye uchilishche im. Baumana
(Advanced School of Technology im. Bauman)

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PROKHOROV, N.N.

PHASE I BOOK EXPLOITATION SOV/4343

Soveshchaniye po teorii liteynykh protsessov, 3d

Usadochnyye protsessy v metallakh; trudy soveshchaniya (Shrinkage Processes in Metals, Transactions of the Third Conference on the Theory of Casting Processes) Moscow, AN SSSR, 1960. 281 p. Errata slip inserted. 3,000 copies printed.

Sponsoring Agency: Akademiya nauk SSSR. Institut mashinovedeniya. Komissiya po tekhnologii mashinostroyeniya.

Resp. Ed.: B.B. Gulyayev, Doctor of Technical Sciences, Professor; Ed. of Publishing House: V.S. Rzhevnikov; Tech. Ed.: T.V. Polyakova.

PURPOSE: This collection of articles is intended for scientific workers, engineers, technicians of scientific research institutes and industrial plants, and for faculty members of schools of higher education.

COVERAGE: The collection contains technical papers presented at the Third Conference on the Theory of Casting Processes, organized by Liteynaya sektsiya Komissii po tekhnologii mashinostroyeniya Instituta mashinovedeniya AN SSSR (Casting Section of the Commission for Machine-Building Technology of the Institute of Science of Machines, Academy of Sciences USSR) and by Institut metallurgii imeni Baykova AN SSSR (Institute of Metallurgy imeni A.A. Baykov, Academy of Sciences USSR). The most serious defects in castings, ingots, and welds as a result of metal shrinkage are reviewed. Factors contributing to the formation of shrinkage cavities, porosity, cracks, fissures, distortion, and internal stresses are analyzed along with measures taken to prevent and remedy them. The hydrodynamics of molten metals and the process of solidification of metals are discussed. Also presented are resolutions adopted at the Conference with regard to the problem of shrinkage in metals. No personalities are mentioned. Most papers are accompanied by bibliographic references, the majority of which are Soviet.

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Shrinkage Processes (Cont.) SOV/4343

AVAILABLE: Library of Congress (TS230.C7)

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83679

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A006/A001

1.2300 only 2208

AUTHORS: Bochvar, A. A., Academician, AS USSR, Rykalin, N. N., Corresponding Member of AS USSR, Prokhorov, N. N., Professor, Doctor of Technical Sciences, Novikov, I. I., Candidate of Technical Sciences, Movchan, B. A., Candidate of Technical Sciences

TITLE: On the Problem of "Hot" (Crystallization) Cracks

PERIODICAL: Svarochnoye proizvodstvo, 1960, No. 10, pp. 3-4

TEXT: Information is given on results of investigations made by various authors on the technological strength of metal against hot crack formation. The following basic points in the problem of crystallization cracks are stated: 1. In analyzing the technological strength, two main peculiarities of the conditions in which this strength manifests itself during welding and casting processes must be taken into account: a) the technological strength appears during the cooling of the work when phase transformations in the metal and structural changes take place, b) the technological strength manifests itself under conditions of mutually equilibrated stresses, i. e. when stresses in the zones of local changes in the specific volume of the cooling metal are balanced

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On the Problem of "Hot" (Crystallization) Cracks

by stresses arising in the adjacent zones. 2. Crystallization cracks arise in the crystallization range of the metal and may develop in the solid state during cooling. A sharply pronounced drop of ductility of the alloys, named the temperature range of brittleness, is observed in the "effective" crystallization range. The basic mechanism of plastic deformation in the liquid-solid state consists in the mutual displacement of crystallites. The upper limit of the "effective" crystallization range is the temperature of interlacing and coalescence of the dendrites; its lower limit is the temperature range of brittleness. When passing through this range, the deformation mechanism changes abruptly and plastic deformation of the crystallites develops intensively together with intercrystallite displacement. 3. The theory of the technological strength in welding and casting must be based on the comparison of processes of deformation and changes in ductility. The notion that the alloys are not ductile in solid-liquid state is not correct. The alloy being in solid-liquid state has, within the temperature range of brittleness, a ductility which is characterized by small values of relative elongation. It was experimentally established that the relative elongation of the alloy in the "effective" crystallization range was commensurable with the deformation in this zone. It is precisely the ductility of alloys in solid-liquid state that ensures the technological strength

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On the Problem of "Hot" (Crystallization) Cracks

in welding and casting, and data on the ductility of the alloys in this state permit the evaluation of their technological strength. 4. The technological strength reserve in casting or welding depends on the correlation between the temperature range of brittleness, ductility in this range, and the intensity of elastic-plastic deformation increasing with dropping temperature. All these three values must be considered when evaluating the strength reserve. 5. Changes in crack sensitivity can be determined by one of the characteristics if the two others remain constant. 6. Cracks in casting may be filled up by hydrostatic pressure and capillary forces. 7. Factors determining the temperature range of brittleness ductility and the deformation rate are enumerated.

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A133/A133

AUTHORS: Bochvar, A. A., Rykalin, N. N., Prokhorov, N. N., Novikov, I. I., Movchan, V. A.

TITLE: On the problem of hot (crystallization) cracks during casting and welding

PERIODICAL: Liteynoye proizvodstvo, no 10, 1960, 47

TEXT: Based on the mass of experimental material which has been accumulated hitherto, the authors present some generalized survey on the problem of hot cracks originating during casting and welding. They point out that, when the technological strength is analyzed, two peculiarities have to be taken into account: a) the technological strength develops during the cooling process, b) the technological strength develops under conditions of mutually balanced stresses. They deny the possibilities of experimentally determining the elastic and plastic deformation of the metal during welding or casting by measuring the component being cast or welded. Then the authors emphasize that hot cracks originate during the

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metal crystallization interval and can develop during the metal cooling in the solid state. In the "effective" crystallization interval a sharp dip of the alloy plasticity can be observed, which the authors call temperature interval of brittleness. The upper boundary of the "effective" crystallization interval is the temperature at which dendrites interlace and intergrow in the crystalline skeleton. The lower boundary of the "effective" crystallization interval is the temperature of the actual solidus. At this point the mechanism of metal deformation changes abruptly: the plastic deformation of the crystallites themselves intensively develops together with intercrystalline displacements. The authors point out that the idea of alloys in the solid-liquid state not possessing plasticity is unfounded. This would lead to the conclusion that hot cracks are inevitable during welding and casting, which is not the case. Next the authors state that the technological stength reserve of castings and welds depend on the interrelation of three characteristic features: temperature interval of brittleness, plasticity in this interval and the intensity of

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growth of elastic-plastic deformation as far as the temperature decreases, i. e. the deformation rate. It is maintained that the technological strength reserve can be quantitatively rated neither by the magnitude of the temperature interval of brittleness, nor by the magnitude of relative elongation in this interval, nor by the deformation rate, each taken separately. Thus the direction of variation of hot-shortness can in the first approximation only be determined by the variation of one of the three above-mentioned factors if the two others remain unchanged. Cracks originating in castings can be filled with molten metal under the effect of hydrostatic pressure and capillary forces. The magnitude of the temperature interval of brittleness is determined by the chemical composition of the alloy, the content of additives located along the grain boundaries, dendritic liquation, dimensions and shape of crystallites, rate of cooling and deformation. The plasticity of the alloy in the"effective" crystallization interval is determined by the following factors: ratio of solid to liquid phase volume, dimensions and shape of crystallites and kind of distribution of the

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liquid phase, chemical and structural micro-nonhomogeneity, rate of deformation. The rate of deformation is determined by the thermal coefficient of linear contraction, the rigidity of the welding joint or yielding of the linear shape, kind of temperature distribution determining the degree of deformation concentration and also by the deformation of the parts being cast or welded. Length and width of cracks cannot serve as measure of resistance of the metal against the formation of hot cracks. The authors conclude by stating that the difference between the minimum relative elongation in the "effective" crystallization interval and the magnitude of free temperature deformation (linear shrinkage) at the temperature of this minimum can be used as quantitative characteristic of the resistance of metal to the origination of hot cracks.

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BEL'CHUK, Georgiy Aleksandrovich, kand. tekhn. nauk, dots., prepodavatel'; MATSKEVICH, Vadim Dmitriyevich, kand. tekhn. nauk, dots., prepodavatel'; DEMYANTSEVICH, V.P., dots., kand. tekhn. nauk, nauchnyy red.; PROKHOROV, N.N., prof., doktor tekhn. nauk, retsenzent; KAZAROV, Yu.S., red.; KOROVENKO, Yu.N., tekhn. red.

[Welding in shipbuilding] Svarka v sudostroenii. Leningrad, Gos. soiuznoe izd-vo sudostroit. promyshl., 1961. 431 p. (MIRA 14:10)

1. Kafedra "Svarka sudovykh konstruktsiy" Leningradskogo korablestroitel'nogo instituta (for Bel'chuk, Matskevich).
(Shipbuilding) (Welding)

S/135/61/000/002/002/012
A006/A001

AUTHORS: Prokhorov, N. N., Professor, Doctor of Technical Sciences, Mastryukova, A. S., Candidate of Technical Sciences

TITLE: Calculation of the Crystallization Scheme of a Weld Joint

PERIODICAL: Svarochnoye proizvodstvo, 1961, No. 2, pp. 4-8

TEXT: The technological and operational strength of welds depend on their crystallization scheme, i. e. on the orientation of columnar crystal boundaries in respect to the weld axis and their shape. There are different opinions in literature on the nature of crystallization of weld joints. M. V. Shamanin (Ref. 3) and G. L. Petrov (Ref. 4) consider that the rate of crystal growth increases when the growing crystals approach the center of the weld joint. In the case of directed crystallization the process takes place under conditions of orthogonality of columnar crystallite axes in respect to the isothermal surfaces of solidification. Thus the theoretical analysis of the crystallization system will be based on concepts on the nature of a temperature field during welding process. For this purpose N. N. Rykalin's theory on heat propagation in welding process can be used (Ref. 5). The authors studied the problem whether the crystallite axes were

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Calculation of the Crystallization Scheme of a Weld Joint

actually orthogonal to the isothermal surfaces of solidification and investigated a number of weld joints produced under different conditions (Fig. 1). They developed equations to calculate the crystallization scheme of weld joints, the angle $\frac{\theta}{2}$ formed between the tangent of the crystallite axis and the direction of displacing the heat source, and the crystallization rate. It was found that the disposition of crystallites of the weld joint exerted a substantial effect on its deformability in the temperature range of brittleness. To estimate the deformability of weld joints in this temperature range data are needed on the crystallite size, shape and orientation. The size and orientation of crystallites depend on the compostion of the alloy, the crystallization rate and the shape of the isothermal surface of crystallization. Calculations of the $\frac{\theta}{2}$ angle showed that 1. the inclination of crystallite axes when changing welding conditions, vary only in areas which are remote from the seam axis and the fusion zone, remaining constant in the indicated area; 2. at a given value of linear energy, values of the $\frac{\theta}{2}$ angle increase with a higher welding speed, i. e. the crystallites are mainly oriented along the axis Y. 3. At a given welding speed the increase in linear energy causes higher values of $\frac{\theta}{2}$ and result in a reduced ductility of the weld joint in transverse direction. Figure 10, illustrating the dependence of the

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A006/A001

Calculation of the Crystallization Scheme of a Weld Joint

crystallization rate on k proves that 1. mean values of the solidification rate of weld joints increase with a decrease of the parameter k, i. e. when approaching the center of the weld joint; the solidification rate attains, in the center of the seam, values equalling those of the welding speeds. 2. at a given value of the energy the solidification rate of the weld joint increases with a higher welding speed; but only in the center of the weld joint ($k = 0 \div 0.3$). In this zone processes of non-uniform crystallization are actually developing, promoting the appearance of a disoriented structure. 3. at a given welding speed the decrease of energy causes the equalization of solidification rate values over the section of the weld joint. The authors conclude that the shape and disposition of the crystallites are determined by two opposite tendencies. The one, determining the orthogonality of crystallites in respect to the isothermal surfaces of solidification, depends on the welding conditions and the shape of the welded work. The other, determining the rectilinearity of crystallites and disturbing the conditions of orthogonality, depends on the conditions preserving a minimum of free surface energy of crystallites. This tendency depends mainly on the nature of crystallite bonds, i. e. on the metal property. Assuming that the vector of the crystallization rate was directed perpendicular to the isotherm of solidification, it was

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Calculation of the Crystallization Scheme of a Weld Joint

possible to calculate the shape of crystallite axes and the scheme and rate of crystallization depending on welding conditions, by taking into account thermo-physical properties of the materials welded. Further experiments are needed to determine to what extent the second tendency affects the crystallite shape. Based on concepts on the incontinuity of the deformation field in the brittle temperature range the correlation of the crystallization scheme and the ductility of weld joints in this range is shown. This establishes one of the connections between the welding conditions and the technological strength of welds joint in crystallization process.

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Calculation of the Crystallization Scheme of a Weld Joint A006/A001

Figure 1
Structure of the surface of a weld: a - on 18-8/grade austenitic steel, x 100; b - on ВТ-14 (VT-14) titanium alloy x 30; c - on АМгМ(AMgM) aluminum alloy x 50.

Figure 1:

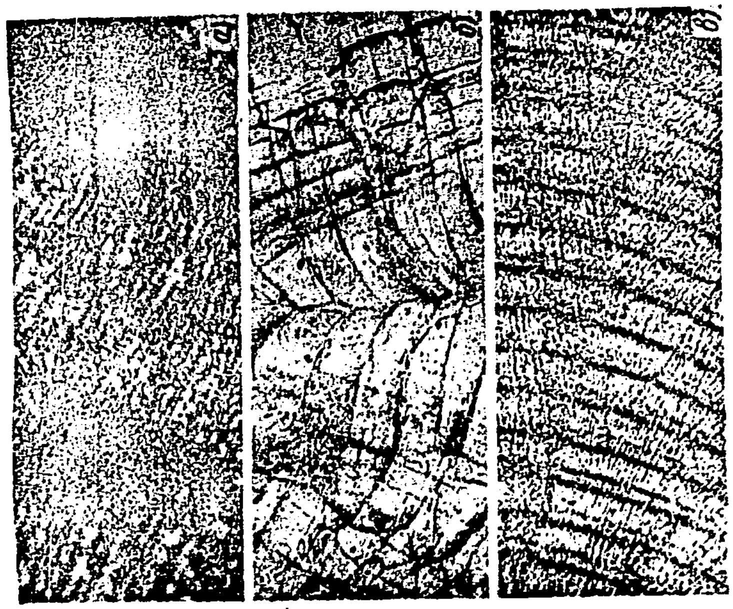

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Figure 8
Dependence of the angle $\frac{\theta}{2}$ on k, for "St.3" steel

Figure 10
Dependence of crystallization rate on k

There are 10 figures, 2 tables and 6 Soviet references.

ASSOCIATION: MVTU imeni Bauman

Figure 8:

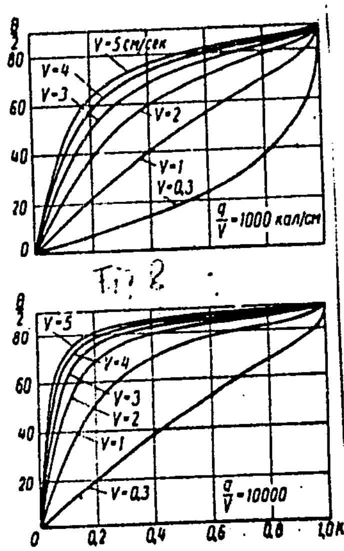
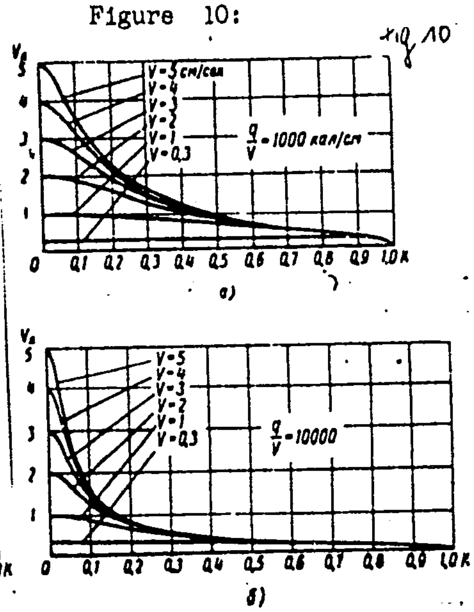


Figure 10:



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D040/D113

AUTHORS: Prokhorov, N.N. and Makarov, E.L.

TITLE: Methods of determining and controlling the resistance of steels to cold cracking during welding

PERIODICAL: Avtomaticheskaya svarka, 14 no. 11, 1961, 3-13

TEXT: A detailed description of a new cold cracking test method is given, and the hypothesis of steel strength on which the method is based, is discussed. The principle of the method consists in the application of an external force, produced by a weight, during the time when austenitic transformation occurs in the welded specimen. The method, suggested by N.N. Prokhorov, was verified in experiments with various steel grades and electrode materials in manual and automatic welding. It is stated that existing tests for the technological strength of steel in welding do not always properly reflect the strength under actual welding conditions, and reference is made in this connection to several foreign and Soviet tests including those conducted by K.G. Nikolayev and B.A. Gololobov (Ref. 4: "Svarochnoye proizvodstvo", No. 9, 1956). The theory underlying the new method provides for a subdivision of

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the stresses in the welded metal into active (in the weld and the affected zone) and reactive (in base metal beyond the affected zone) stresses, and the applied external load imitates the "reactive" effect. The shape of specimens may be different - T, butt joint, etc. A T-specimen and the suggested test machine design are illustrated (Fig. 1 and 2). The test consists in loading a series of specimens with weights of different sizes. Load is gradually applied 2-30 minutes after welding, for a period of 0.5-1 minute, and is held for at least 20 hours. The time of complete rupture of the specimens is fixed, and specimens left solid are investigated for cracks. The test results are presented in graphs showing the destructive stresses and destruction time. The quantitative cracking resistance index is the minimum tensile stress that causes rupture or cracks. Cracks are revealed by etching with a weak solution of nitric acid poured on the metal. The minimum possible loading time is conditioned by the cooling of the affected zone, down to 400-350°C, i.e. the start of austenitic transformation. The specimens have to be large enough to allow internal stresses, depending on the properties of the weld and the base metal, to form. The article includes details of test techniques,

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specimen dimensions, the composition of some of the tested steel grades, and graphs illustrating the test results. The effect of various technological means of raising the crack resistance was investigated, i.e. preheating, roasting of electrodes and fluxes, forging, selecting the composition of weld metal, etc. Forging is stated to be a very effective means of combatting cracking in the affected zone, which is apparently due to stress relief in the specimens. There are 6 figures, 3 tables and 9 references: 6 Soviet and 3 non-Soviet-bloc references. The three references to English-language publications read as follows: C.L.M. Cottrell, H.D. Jackson, I.G. Whitman, Control of Cracking in Arc Welding High Tensile Structural Steels, "Welding Journal", No. 4, 1952; S.L. Hoyt, C.E. Sims, H.M. Banta, Metallurgical Factors of Underbead Cracking, "Welding Journal", No. 9, 1945; C.B. Voldrich, Cold Cracking in the Affected Zone, "Welding Journal", No. 3, 1947.

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ASSOCIATION: MVTU im. Baumana (MVTU im. Bauman)

SUBMITTED: June 19, 1961

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S/135/62/000/004/001/016
A006/A101

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AUTHOR: Prokhorov, N. N., Professor, Doctor of Technical Sciences

TITLE: Technological strength of metals during the crystallization process in welding

PERIODICAL: Svarochnoye proizvodstvo, no. 4, 1962, 1-5

TEXT: The author explains the theory of the technological strength of metals during crystallization in welding. Methods are given for the quantitative estimation of technological, metallurgical and structural factors, which predetermine the conditions of technological strength. The theoretical explanations are illustrated by a series of graphs and a diagram of the thermo-mechanical state of metals. The author concludes that conditions of the appearance of technological strength are in principle different from those when the parts are subjected to stress load from external forces. If this fact is not taken into account serious errors can arise, such as measuring of internal stresses by simple tensometry and neglecting thermokinetic phenomena when evaluating the properties of metals which had been subjected to phase changes. The technological strength of parts during welding and casting can only be evaluated by a comparison

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of the extremal deformation rate, the rate of free shrinkage of the alloy, and the rate of deformations caused by changes in shape of the part during welding and casting. The difference of the extremal deformation rate and the rate of free shrinkage can in the first approximation be considered as an index of the technological strength of the alloy. The extremal or permissible deformation rate in the first approximation. is determined by the relationship of the minimum ductility of the metal in the brittle temperature range and the magnitude of this range. The temperature range of brittleness can in the first approximation be thermodynamically determined from the constitutional diagram. The accurate determination of this range can be obtained by the experimental evaluation of kinetics of changes in the mechanical properties of the alloys during melting and crystallization. The value of the brittle temperature range depends on the composition of the alloy, the thermal cycle, affecting the degree of chemical heterogeneity; and also, to some extent, on the temperature field determining the crystallization sequence of the weld joint or the casting. All the alloys suffer during melting or crystallization a dip of ductility in the zone of intercrystalline failure. The established dependence of ductility on temperature of crystallizing or melting alloys is universal and can be applied to any metal system. Ductility within the brittle temperature range is a function of the alloy

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composition, affecting the size and shape of crystallites; of the thermal cycle, affecting the structure and deformation rate; and of the nature of the temperature field affecting the degree of deformation concentration during welding. The relative quantitative value of the technological strength index can be experimentally determined only on the basis of determining the critical value of the deformation rate of the specimen in the machine. At a given thermal cycle this value is proportional to the displacement speed of the machine clamps. The effect of the thermal welding cycle on the technological strength index of different alloys can be established by determining the critical deformation rate values during alternating welding conditions. The effect of the weld shape on the deformation speed of changes in the shape can be determined by welding the given joint using various alloys with different technological strength factors. The lower this factor, when cracks arise, the lower is the deformation rate of changes in shape, depending on the given weld joint type, i.e. in case of the given weld joint the arising of cracks is most probable. The practical solution of the problem of the technological strength can be solved by selecting the composition of alloys, conditions and sequence of welding and by developing efficient types of weld joints. The aforementioned measures and the selection

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of methods to raise the technological strength, should be dictated by their economical efficiency. There are 6 figures and 2 Soviet-bloc references.

ASSOCIATION: MVTU imeni Bauman

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S/128/62/000/004/006/010
A004/A127

1.1509

AUTHOR: Prokhorov, N.N.

TITLE: Technological strength of metals in the crystallization process during casting

PERIODICAL: Liteynoye proizvodstvo, no. 4, 1962, 24 - 27

TEXT: The author points out that the technological strength of metals is not impaired if its deformability over the whole cooling period of the casting remains higher than the corresponding values of originating deformations. He emphasizes the difference between the service strength and technological strength of metals and states that the first characteristic determining the conditions of technological strength is the interequilibrium of the stress field. The second essential difference of the conditions of technological strength consists in that, in this case, the metal is in a process of phase and structural transformations, while under service conditions it is in a stable or metastable state. The author presents a diagram illustrating the theory of technological strength based on a comparison of three parameters which are determined by the kinetics of changes of the deformability of crystallizing alloys and by the process of deformation de- X

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Technological strength of metals in S/128/62/000/004/006/010
A004/A127

velopment. The author derives a number of formulae to calculate the inner deformation, magnitude of technological strength reserve, etc., and presents a diagram of the dependence of the deformation rate on the structural technological factors and the alloy composition. He describes tests carried out with V-shaped rods to determine at which deformation rates cracks are originating in the given alloy. To improve the methods of testing the technological strength of metals during casting, a method and machine design are suggested, where value a_f (deformation rate depending on the deformation of the workpiece) is changed compulsorily by an electric motor using a mechanical drive. A schematic and description of the testing machine is given. The index of the tendency of an alloy to form cracks during the crystallization process can be determined by the values of the deformation rate at which cracks are beginning to originate. The experimental test results of the machine showed that it is possible by the suggested method to determine the index of technological strength of any alloy. In his conclusions the author points out that the theory of technological strength of metals in the crystallization process during casting has quite a lot in common with the theory of strength during welding, which to a considerable extent also predetermines the community of methods to evaluate the technological methods in these processes. There are 8 figures.

X

Card 2/2

30587
S/128/62/000/004/007/010
A004/A127

18.7500

AUTHOR: Prokhorov, N.N

TITLE: The plasticity of crystallizing metals

PERIODICAL: Liteynoye proizvodstvo, no. 4, 1962, 27 - 30

TEXT: To determine the nature of the change of plasticity of metals during the crystallization or melting process, the author presents the following temperature function:

$$P = P_0 + \frac{1}{(T - L_1)^n (U_1 - T)^m},$$

where P - metal plasticity during the crystallization or melting process; U_1 and L_1 - temperature corresponding to the upper and lower limits of the temperature range of brittleness; P_0 = constant, depending on the size and shape of crystallites and also on the deformation rate; n and m - empirical constants depending on the rate of metal crystallization or melting at various temperatures. As an example, the author presents in a graph the plasticity characteristics of Al-alloys with silicon during the crystallization process, which he obtained together with M.P. Bochay. For an analytical determination of the plasticity of alloys in X

Card 1/3

S/128/62/000/004/007/010
A004/A127

The plasticity of crystallizing metals

the temperature range of brittleness, the author describes the deformation mechanism of two-phase solid-liquid metals and states that the plasticity of solid-liquid metals in the first approximation can be evaluated by the free displacement of crystallites up to their contact in individual points, i.e., up to their blocking up. Moreover, it is shown that the metal plasticity can be evaluated by the plane-parallel and rotating displacements of crystallites under the given conditions. The author derives a number of formulae determining the angle of free rotation of the crystallite, the relation between the areas of the liquid and the solid phases and the dependence of the angle on various parameters. He states that the predominant development of crystallites in one or the other direction mostly affects the plasticity of metals which have an almost equiaxial structure. Based on his investigations of the various factors affecting the plasticity of crystallizing metals, the author concludes that an analysis of the metal properties in the processes of crystallization and melting is only possible, if the sharp difference between the mechanical properties of liquids and crystallites are taken into account, as well as the different nature of changes of these properties depending on the temperature. Moreover, the nature of changes of the metal plasticity during the crystallization process is determined by the kinetics of crystallization and by the size and shape of the originating crystallites.

Card 2/3

S/128/62/000/004/007/010
A004/A127

The plasticity of crystallizing metals

The conception of an intermittent (discrete) deformation mechanism of solid-liquid metals, by which the crystallites are displaced in relation to each other on account of a circulation of the liquid phase, makes it possible in the first approximation to evaluate the reduction in plasticity with the decrease of the liquid phase volume, and to evaluate the effect of the grain size and the crystallite shape on the plasticity of crystallizing or melting metals. There are 9 figures.

X

Card 3/3

38259
S/135/62/000/006/001/014
A006/A106

1.2300

AUTHORS: Prokhorov, N. N., Professor, Doctor of Technical Sciences,
Mastryukova, A. S., Candidate of Technical Sciences

TITLE: Calculating the scheme of weld metal crystallization in butt welding of plates

PERIODICAL: Svarochnoye proizvodstvo, no. 6, 1962, 2-3

TEXT: To establish the relationship between hot crack formation and the nature of the weld metal crystallization scheme in butt welding of plates, a method was developed of calculating the crystallization scheme and the solidification rate of the weld metal. The following basic equations were obtained for the crystallite axis, the angle ξ, formed by the tangent to the crystal axis and the seam axis and the solidification rate, for the case when the plate was heated with a linear source moving at any speed:

$$= \frac{\vartheta^2 \ldots}{\vartheta_M} \cdot 1.164 \frac{1}{vc\gamma} \Psi ; \qquad (11)$$

Card 1/2

S/125/62/000/006/001/014
A006/A106

Calculating the scheme of weld metal ...

$$\frac{\theta}{2} = \text{arctg}\left(\frac{\nu_M}{\nu_N} \cdot 0.208 \frac{q}{\lambda \delta T} \zeta\right); \qquad (12)$$

$$v_x = \frac{v}{\sqrt{1 + \left(\frac{\nu_M}{\nu_N}\right)^2 0.043 \frac{q^2}{\lambda^2 \delta^2 T^2} \zeta^2}} . \qquad (13)$$

There are 4 figures.

ASSOCIATION: MVTU imeni Bauman

Card 2/2

PROKHOROV, N.N., doktor tekhn.nauk, prof.; IGNAT'YEVA, V.S., kand.tekhn. nauk

Solving the problem of phase stresses during the welding of hardenable steel, as a particular case in the solution of the temperature problem in the elasticity theory. Trudy MVTU no.106:38-46 '62. (MIRA 16:6)
(Steel—Metallography) (Phase rule and equilibrium)

PROKHOROV, N.N.; LIGNAT'YEVA, V.S.

Phase stresses during welding. Avtom.svar. 15 no.4:8-14 Ap '62. (MIRA 15:3)

1. Moskovskoye vyssheye tekhnicheskoye uchilishche imeni Baumana.
(Welding) (Phase rule and equilibrium)

41865
S/549/62/000/106/004/010
I003/I203

1.2300

AUTHORS: Prokhorov, N.N., Doctor of Technical Sciences, Professor, Gavrilyuk, V.S., Ingegneur and Yakushin, B.F., Ingegneur

TITLE: Universal testing machine ЛТП-1-4 (LTP-1-4) for determining the resistance of welds to hot cracking

SOURCE: Moscow. Vysshoye tekhnicheskoye uchilishche. [Trudy] no. 106, 1962. 114-122. Svarka tsvetnykh splavov i nekotorykh legirovannykh staley

TEXT: The main draw-back of testing machines in use at present is the discrepancy between the conditions under which the deposited metal solidifies during service and those during testing. The excellent performances claimed for this machine permit the obtaining of welding conditions comparable with practical ones. The machine consists of the following essential elements: 1. a device for stressing the sample; 2. a welding device; 3. devices for recording the testing conditions. A comparison of the data obtained by this method (called МВТУ (MVTU)) with those obtained by testing samples welded under industrial conditions showed a satisfactory agreement and the authors therefore recommend the use of this machine in all industrial and scientific laboratories. There are 7 figures.

Card 1/1

S/549/62/000/106/005/010
I003/I203

AUTHOR: Prokhorov, N.N., Doctor of Technical Sciences, Professor, and Bochay, M.P., Cand. Techn. Sciences

TITLE: Determination of the intercrystalline strength of alloys during solidification

SOURCE: Moscow. Vyssheye tekhnicheskoye uchilishche. [Trudy] no. 106, 1962. 123-128. Svarka tsvetnykh splavov i nekotorykh legirovannykh staley

TEXT: In order to avoid hot-cracking it is necessary to have a sound knowledge of the chemical composition as well as of the processes taking place in the weld. In the present work the variation in strength and plasticity of Al-Cu alloys during solidification was investigated and conclusions were drawn as to their resistance to hot-cracking during welding. Alloys with a low plasticity in the zone of hot brittleness also display the lowest resistance to hot-cracking. There are 5 figures and 2 tables.

Card 1/1

PROKHOROV, N.N., doktor tekhn.nauk, prof.; BOCHAY, M.P., kand.tekhn.nauk

Determining the safety factor for intergranular cracking occurring during the crystallization process. Trudy MVTU no.106:123-129 '62. (MIRA 16:6)
(Thermal stresses) (Crystallization)

MASTRYUKOVA, A.S.; PROKHOROV, N.N.

Criteria for the pattern and rate of crystallization of weld joints. Avtom. svar. 16 no.7:8-14 Jl '63. (MIRA 16:8)

1. Moskovskoye vyssheye tekhnicheskoye uchilishche im. Baumana.
(Welding) (Crystallization)

PROKHOROV, N.N., doktor tekhn. nauk; GOSPODAREVSKI., V.I., inzh.; SUBBOTIN, Yu.V., inzh.

Investigating transverse deformations of a metal seam in the butt welding process of plates. Svar. proizv. no.9:1-3 S '64. (MIRA 17:12)

1. Moskovskoye vyssheye tekhnicheskoye uchilishche im. Baumana.

PROKHOROV, N.N.; , N. Nicole

Calculation of deformations in the welding proce during the deposition of a bead on the edge of plates. Avtom. svar. 17 no. 5:54-62 My '64. (MIRA 17:11)

1. Moskovskoye vyssheye tekhnicheskoye chilishche imeni Baumana.

PROKHOROV, N.N.; ARUTYUNOVA, I.A.

Quantitative test specimens for the determination of the technological strength of metals in the crystallization process. Avtom. svar. 17 no.7:6-10 Jl '64. (MIRA 17:8)

1. Moskovskoye vyssheye tekhnicheskoye uchilishche im. Baumana.

L 65084-65 EWT(m)/EWP(v)/T/EWP(t)/EWP(k)/EWP(b)/EWA(c) JD/HM

ACCESSION NR: AP5021220

UR/0125/65/000/008/0015/0021

621.791.011.001

AUTHOR: Prokhorov, N. N. (Doctor of technical sciences); Mastryukova, A. S. (Candidate of technical sciences)

TITLE: Primary structure and its significance in estimating the strength of weld metal

SOURCE: Avtomaticheskaya svarka, no. 8, 1965, 15-21

31
30
B

TOPIC TAGS: primary structure, weld metal, constitutional supercooling, metal structure, crystallization rate, temperature gradient, phase interface, columnar structure, dendritic structure, crystallite, weld center

ABSTRACT: Using the statistical approach, the author examines the role of the structural factor in the strength of weld metal, its effect on the stress-strain diagram. It is shown that the degree of constitutional

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L 65084-65
ACCESSION NR: AP5021220

width of the weld joint are calculated and the pattern of distribution of values of the constitutional supercooling criterion along the crystallization isotherm is

ASSOCIATION: MVTU im. Baumana

SUBMITTED: 17Jul64 ENCL: 00 SUB CODE: SS, MM

NR REF SOV: 006 OTHER: 000

Card 2/2 mlk

L 16380-65 EWT(m)/EWP(w)/EWA(d)/EPR/EWP(t)/EWP(k)/EWP(b) Pf-4/Ps-4 IJP(c)/
ACCESSION NR: AP4041859 ASD(f)-2 JD/HW S/0125/64/000/007/0006/0010

AUTHOR: Prokhorov, N. N. (Doctor of technical sciences); Arutyunova, I. A. (Candidate of technical sciences)

TITLE: Quantitative testing for the determination of the mechanical and physical strength of metals in the process of crystallization

SOURCE: Avtomaticheskaya svarka, no. 7, 1964, 6-10

TOPIC TAGS: quantitative test, deformation, rigidity, crack formation, Al, Fe, Nimonic

ABSTRACT: The authors propose a new quantitative method according to which the successively decreased inner deformation as a result of increasing the rigidity of the specimens is taken into account. Fe-Al and Nimonic sheets were welded in the direction of the widening of the plates. A crack forms in the direction of the joint and the molten pool following the axes of the columnar crystallites and spreading subsequently along their joint in the center of the weld. The crack on each of the specimens forms at the onset of the joint only to disappear towards its end. Thus, at the early stage of welding of each successive

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... in accordance with the circumstances determined by the

Card 1/2

L 16380-65
ACCESSION NR: AP4041859

rigidity of that plate and the welding conditions. Orig. art. has: 9 figures.

ASSOCIATION: MVTU im Bauman

SUBMITTED: 27Jul63

ENCL: 00

SUB CODE: MM

NO REF SOV: 004

OTHER: 000

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Card 2/2

ACC NR: AT6030946 (N) SOURCE CODE: UR/0000/66/000/000/0227/0242

AUTHORS: Makarov, E. L. (Candidate of technical sciences); Subbotin, Yu. V. (Engineer); Prokhorov, N. N. (Doctor of technical sciences)

ORG: none

TITLE: Means for increasing the resistance of steels to the formation of cold cracks during welding

SOURCE: Moscow. Vysheye tekhnicheskoye uchilishche. Prochnost' svarnykh konstruktsiy (Strength of welded sturctures). Moscow, Izd-vo Mashinostroyeniye, 1966, 227-242

TOPIC TAGS: weld effect, weld evaluation, metal welding, welding equipment, welding technology, metal bonding

ABSTRACT: An analysis was made and an experimental study was conducted to determine means for increasing the resistance of steels to the formation of cold cracks during welding. Basically, nine methods are identified: 1) the rational alloying of basic and built-up metal; 2) the selection of weld materials of a defined content with minimal hydrogen content; 3) the selection of the optimal technology and welding conditions; 4) the processing of the basic metal before welding so as to obtain a favorable base structure; 5) the elimination of the effect of stress concentrators by varying the surface layer properties of the metal; 6) control of the welding thermal cycle; 7) thermomechanical treatment of the weld joint during cooling in the welding

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ACC NR: AT6030946

process; 8) thermal treatment of the weld joint immediately after welding; 9) mechanical working at the weld joint immediately after welding. The results of several weld strength tests are presented. In these tests the strength of the welds was measured for a variety of conditions, including hand and automatic welding, use of several types of weld materials and base materials, direct versus alternating current welding, etc. Other tests were for the purpose of contrasting the effect of preliminary cold working on steel in the normalized versus the annealed condition. Failed specimens are shown, a discussion of the various failure mechanisms is presented, and surface conditions are analyzed with respect to their effects on crack formation. Further experimental analyses were performed on commercial steels to determine the effect of the weld-cooling rate on the weld bond. Test results were compared with theoretical studies on the welding thermal cycle. Orig. art. has: 13 figures.

SUB CODE: 13/ 11/ SUBM DATE: 11Mar66/ ORIG REF: 007/ OTH REF: 014

Card 2/2

L 09137-67 EWT(m)/EWP(j) IJP(c) RM

ACC NR: AP6031282 SOURCE CODE: UR/0229/66/000/008/0063/0063

29
22

AUTHOR: Bagnenko, F. M.; Kayda, Yu. A.; Prokhorov, N. P.; Dudko, T. V.

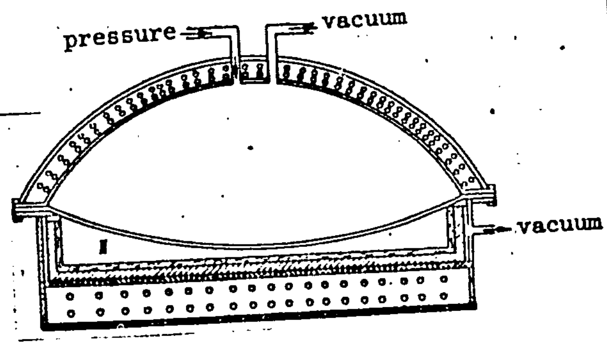
ORG: None

15

TITLE: Production of fiberglass-reinforced plastic products

SOURCE: Sudostroyeniye, no. 8, 1966, 63

TOPIC TAGS: fiberglass, reinforced plastic, plastic fabricating machinery



ABSTRACT: The authors describe the development of a unit for combination forming of cabin doors and heat control panels. The unit was produced at the Kherson Shipbuilding Plant and is composed of a pressing chamber and vacuum chamber (see figure). The pressing chamber is a welded dome-shaped cover equipped with an insulated jacket. The vacuum chamber has doors which are air-tight. A diaphragm is placed between the pressing and the vacuum chambers. This diaphragm does the actual pressing. The unit is heated by tubular electric

UDC: 678.029.46:666.189.211

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L 09137-67 7

ACC NR: AP6031282

heaters. The working temperatures are from 20 to 180°C and are automatically controlled. The following components are used for the products: PN-3(VTU33122-60LSNKh) polyethylene resin, ASTT(6)C_2 and KhTK-1 glass fillers and PKhV-1 foam plastic filler. The filled dies are placed inside the chamber which is preheated to 80-90°C and hermetically sealed. The vacuum initially is set at 600-650 mm Hg and four atmospheres are allowed to pass through the pressure feed after 5 to 6 minutes. The vacuum becomes weaker over a period of 10 to 15 minutes. The entire process takes 30 to 40 minutes. After the molding operation is finished, the pressure in the upper chamber is reduced and the die casting mold is removed through the door. The shell is removed from the mold and filled with PKhV-1 filler after which the cover is glued on. The unit is then placed in a hydraulic press and held for 24 hours. Such doors are 2.5 times lighter than wooden doors and their production saves 12,350 rubles a year. Orig. art. has: 3 figures.

SUB CODE: 13/ SUBM DATE: None

Card 2/2 nst

MAYYER, R.M., inzh.; PROKHOROV, G.N., inzh.; PUSTOVALOV, A.I., inzh.; PROKHOROV, N.S., tekhnik-mekhanik

Wedge connection of a removable blade with a scraper. Gor. zhur. no.11:73 N '64. (MIRA 18:2)

PROKHOROV, N.V., inzh.-ispytatel'

Rheostatic tests of a diesel locomotive without heating of the windings of the main generator. Elek. i tepl. tiaga 6 no.10:13 O '62. (MIRA 15:11)

1. Reostatnaya stantsiya teplovozosborochnogo tsekha Luganskogo teplovozostroitel'nogo zavoda.
(Diesel locomotives--Testing)

PROKHOROV, P.

PROKHOROV, P. (Kirov).

Band-brake device. Pozh.delo 3 no.9:17 S '57. (MIRA 10:9)
(Fire sprinklers)

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PROKHOROV, P., inzh.-kapitan

The engineer, people, technology. Komm. Vooruzh. Sil 4 no. 19: 24-29 O '63. (MIRA 17:7)

L 29381-66 EWT(m)/EWP(t)/ETI IJP(c) JD
ACC NR: AP6019796 SOURCE CODE: UR/0286/65/000/004/0113/0113

49
B

INVENTOR: Prokhorov, A. V.; Shalamov, I. I.; Fetisov, S. G.; Prokhorov, P. A.; Tutov, I. Ye.; Parshin, A. A.; Kavesh, L. D.; Slutskaya, T. M.; Yunger, S. V.

ORG: none

TITLE: Low-alloy steel. Class 18, No 148088

SOURCE: Byulleten' izobreteniy i tovarnykh znakov, no. 4, 1965, 113

TOPIC TAGS: low alloy steel, vanadium, boron, tensile strength, heat resistance

ABSTRACT: A low-alloy steel is proposed which has vanadium and boron added to it to increase strength and heat resistance. Its chemical composition is: 0.13-0.18% C, 1.2-1.6% Mn, 0.5-0.8% Si, 0.3-0.6% Cr, 0.15-0.25% Mo, 0.08-0.12% V and 0.003% (max) B. [JPRS]

SUB CODE: 11, 20 / SUBM DATE: none

Card 1/1 CC